



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification<sup>6</sup>:

F16D 63/00

A1

(11) International Publication Number:

WO 96/41085

(43) International Publication Date:

19 December 1996 (19.12.96)

(21) International Application Number: PCT/US96/08159

(22) International Filing Date: 30 May 1996 (30.05.96)

(30) Priority Data:

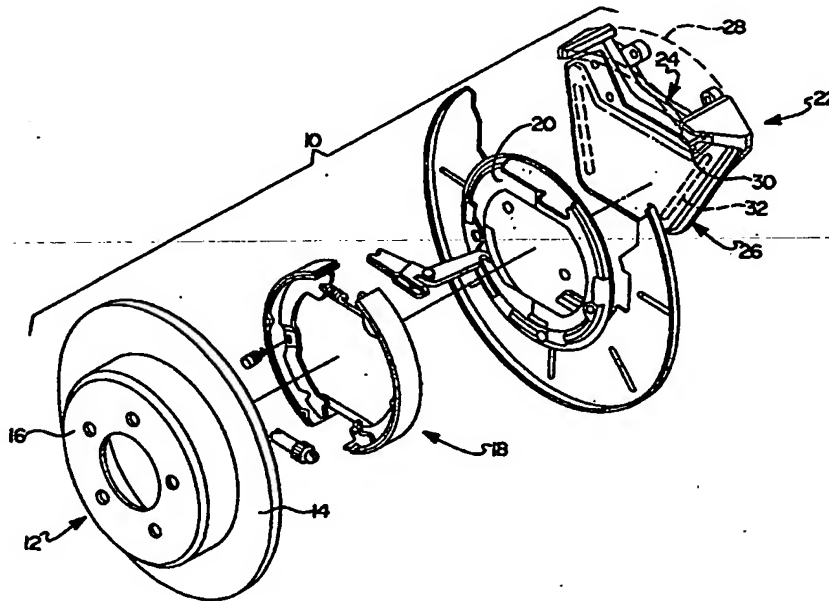
08/475,144

7 June 1995 (07.06.95)

US

(71) Applicant: ITT MANUFACTURING ENTERPRISES, INC.  
[US/US]; 1105 North Market Street, Wilmington, DE 19801  
(US).(72) Inventor: GUTELIUS, Kenneth, E.; 726 Fairledge Avenue,  
Lake Orion, MI 48362 (US).(74) Agent: HINMAN, Kevin, M.; Dykema Gossett P.L.L.C., Suite  
300, 1577 North Woodward Avenue, Bloomfield Hills, MI  
48304 (US).(81) Designated States: CN, European patent (AT, BE, CH, DE,  
DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).**Published***With international search report.**Before the expiration of the time limit for amending the  
claims and to be republished in the event of the receipt of  
amendments.*

(54) Title: STAMPED BRAKE CALIPER ADAPTER



## (57) Abstract

A two-piece stamped caliper adapter (22) includes a cast iron anchor (24) and a stamped steel adapter plate (26). The stamped adapter plate (26) includes reinforcement ribs (32) for providing structural rigidity and stiffness to withstand the loads imposed by a vehicle wheel brake system. A stamped caliper adapter (22) makes a redundant drum brake assembly (18) more readily adaptable to most vehicles and provides other cost-saving economies. In the preferred embodiment, the cast iron anchor (24) and the stamped steel adapter plate (26) are bolted together and the stamped steel adapter plate is spot welded to a drum brake assembly backing plate (20).

BEST AVAILABLE COPY

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

-1-

## Stamped brake caliper adapter

BACKGROUND OF THE INVENTION1. Field of the Invention.

This invention relates to vehicle wheel brake systems. More particularly, this invention relates to a caliper adapter for use in vehicle brake systems that include a disc brake assembly and a redundant drum brake assembly for providing a parking brake function.

2. Description of the Prior Art.

In modern day vehicles, wheel brake assemblies are used that are conventionally known as disc brakes. Disc brakes are preferred for many applications for widely-known reasons. The use of disc brakes for rear wheels on a vehicle, however, introduces certain problems. For example, disc brakes are not ideal for use as a parking brake.

One problem associated with the use of disc brakes for a parking brake, includes a potential deformation of the rotor, which the brakes act upon. When disc brakes have been used for decelerating the rotation of the rear wheels of a vehicle, the disc brake pads typically become very hot. When these same pads are then used for a parking brake function, the pads are clamped about the rotor in a fixed position for a long period of time. The relatively large amount of heat on the disc brake pads has the potential of introducing deformities into the rotor, which can interfere with optimum function of the disc brakes in later braking applications.

Accordingly, it has been proposed to include a redundant drum brake assembly for vehicles that have disc brakes on the rear wheels. Such a configuration would include a

-2-

"drum-in-hat" rotor assembly that has disc brakes acting on a disc portion of the rotor and a drum brake assembly acting on a rotor barrel or hat portion. The drum brakes, in such systems, are used solely for a parking brake function in order to avoid the potential difficulties introduced by using the disc brakes as discussed above.

The presence of a redundant drum brake assembly introduces additional parts and weight to the vehicle brake system. Moreover, the inclusion of the drum brake assembly introduces design challenges in that the brake assembly must be capable of supporting the disc brakes and the drum brakes such that each are functional as required by a particular application. In some instances, special caliper adapters have been used for mounting the disc brakes and for supporting the redundant drum brake assembly. Such adapters are functional, however, they introduce additional weight and, because of their size, are cumbersome and may not be readily adaptable to many vehicle wheel systems. Therefore, it is desirable to provide improved components for vehicle wheel brake systems that include a redundant drum brake for a parking brake feature.

This invention provides an improved caliper adapter that mountingly supports the disc brake assembly and redundant drum brake assembly in an effective manner while also providing space, weight and cost saving advantages.

#### SUMMARY OF THE INVENTION

In general terms, this invention provides a vehicle caliper brake adapter having a first portion made of first type of metal that is adapted to mountingly support a disc brake assembly. The brake adapter has a second portion that is made of a second type of metal, which is connected to the first portion. The second portion has a base and two wings that extend away from the base. The wings preferably provide a connection point between the first and second portions of the

-3-

brake adapter. The base includes at least one reinforcement rib to increase the structural rigidity of the second portion such that it can withstand the forces imposed during the application of a parking brake, for example.

In the preferred embodiment, the first portion of the brake adapter is made of cast iron and the second portion is made from a single stamping of steel. The steel second portion is preferably bolted to the cast iron first portion. The use of steel as a base or second portion of the adapter results in a lighter weight adapter that enhances space, manufacturing and other cost economies.

Various other features and objects of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective exploded view of a vehicle brake assembly including a brake caliper adapter designed in accordance with this invention.

Figure 2 is a planar view of a presently preferred embodiment of a brake adapter designed in accordance with this invention.

Figure 3 is a partial cross-sectional view highlighting portions of the embodiment of Figure 2.

Figure 4 is a partial cross-sectional view highlighting portions of the embodiment of Figure 2.

Figure 5 is a partial cross-sectional view illustrating a reinforcement rib as used with the embodiment of Figure 1.

-4-

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 illustrates, in perspective exploded view, a vehicle wheel brake assembly 10. This type of assembly is commonly known as a drum-in-hat assembly, in part because of the configuration of rotor 12. Rotor 12 includes a disc portion 14 and a drum or barrel portion 16. Drum brake assembly 18 is provided to act upon an inner surface of drum portion 16 in order to provide a parking brake feature. Backing plate 20 provides a mounting surface for drum brake assembly 18.

A disc brake assembly is preferably provided for acting upon disc portion 14 of rotor 12 in order to provide a conventional braking function. Two-piece stamped caliper adapter 22 provides an advantageous device for mounting a disc brake assembly for acting upon disc portion 14. Two-piece caliper adapter 22 includes first portion 24 and second portion 26. First portion 24, also referred to as an anchor, preferably is made of cast iron and is adapted to mountingly support a disc brake assembly (shown in phantom at 28). The disc brake assembly 28 and drum brake assembly 18 are essentially conventional and, therefore, will not be further described in this specification.

Second portion 26 of caliper adapter 22 differs from previous attempts at providing such an adapter for drum-in-hat brake systems, in part, because second portion 26 is made from a single stamping of steel. Second portion 26 is preferably bolted to first portion 24 through the use of bolts 30. Bolts 30 can be a nut and bolt configuration, or, alternatively, bolts 30 can be threaded members that are received within threaded bores defined through first portion 24. Second portion 26 is preferably spot welded to and connected with backing plate 20. Accordingly, second portion 26 provides support for drum brake assembly 18 while also supporting first portion 24, which mounts disc brake assembly 28 in proper position. Therefore, second portion 26 is subjected to loads as caused by actuation of

-5-

either drum brake assembly 18 or disc brake assembly 28. Second portion 26 also serves the function of transmitting such loads to an axle flange (not illustrated). It is therefore necessary that second portion 26 be relatively rigid and structurally capable of withstanding such loads. Accordingly, this invention includes the provision of reinforcement ribs 32 on second portion 26 to increase the stiffness and rigidity of the caliper adapter. Further, the mounting or connection of first portion 24 to anchor 26 further provides greater stiffness and structural rigidity. When first portion 24 is bolted to second portion 26, as generally shown in Figure 1, the cast iron anchor 24 contributes to the stiffness of the overall assembly of adapter 22.

In the most preferred embodiment, second portion 26 and backing plate 20 are stamped separately and spot welded together. In an alternative embodiment, second portion 26 and backing plate 20 are stamped as a single, integral part. In such an embodiment, it is desirable to include a flange, jacket, or covering that would prevent any dirt, debris or water from intruding into the functional space of drum brake assembly 18. The presence of the reinforcement ribs required for the structural rigidity of such an integral part introduces the potential intrusion of such undesirable contaminants.

Figure 2 illustrates, in more detail, the most presently preferred embodiment of the stamped caliper adapter 22. Second portion 26 includes base 40 and wings 42, which extend upwardly (according to the drawing) and away from base 40. First portion 24 is preferably connected to second portion 26 by a connection through wings 42 as illustrated. In the illustrated embodiment, a single reinforcement rib 44 is illustrated by the broken lines. Reinforcement rib 44 is defined by an intersection between a first surface 46 and a second surface 48 on second portion 26. As illustrated, reinforcement rib 44 essentially tracks around the perimeter of

-6-

second portion 26, including a portion of wings 42. First surface 46 is preferably generally planar and lies within a single plane that is parallel and below (as viewed into the page) a plane containing second surface 48.

Figure 4 is a cross-sectional view taken along the line 4-4 of Figure 2. Figure 4 more clearly illustrates the spacial relationship between first surface 46 and second surface 48 of second portion 26. Reinforcement rib 44 is defined by the sloping flange between first surface 46 and second surface 48.

Figure 3 is a partial cross-sectional view taken along the line 3-3 of Figure 2. Figure 3 illustrates the presently preferred connection between first portion 24 and second portion 26. Bolt 30 fits through bores defined in first portion 24 and second portion 26, as illustrated. In the illustrated embodiment, bolt 30 is connected with a nut 50 in order to secure the two portions of adapter 22 together. Alternatively, the bore defined through first portion 24, which is preferably cast iron material, can be a threaded bore that receives a threaded bolt 30 in order to fasten the two portions of adapter 22 together.

Figure 5 illustrates, in cross-sectional view, another preferred embodiment of a reinforcement rib. Rib 32, as illustrated in Figure 5 corresponds to the reinforcement ribs illustrated in the embodiment of Figure 1, for example. By providing such raised reinforcement ribs in the stamped steel second portion 26, the structural rigidity of that piece is enhanced. Such reinforcement ribs are important in order to provide a sufficiently strong adapter, designed in accordance with this invention.

Other mounting devices for drum-in-hat wheel brake assemblies were made of all cast iron in order to provide the necessary stiffness or structural integrity. This invention provides a more efficient device in that stamped steel is lighter weight, takes up less volume, and is less costly for manufacturing purposes. The use of a stamped caliper adapter



-7-

designed in accordance with this invention provides improved vehicle economies in that the weight of the brake system is reduced, improved manufacturing economies in that cost savings in materials and space are achieved, and design economies in that the lesser volume required by a stamped caliper adapter designed in accordance with this invention makes a drum-in-hat wheel brake assembly more readily adaptable to most vehicles.

The preceding description is exemplary rather than limiting in nature. Variations and modifications will become apparent to those skilled in the art that do not depart from the purview and spirit of this invention. The scope of this invention is to be limited only by the appended claims.

---

CLAIMSWhat is claimed is:

1. A vehicle wheel brake system, comprising:  
a rotor having a disc portion and a drum portion;  
a disc brake assembly for acting on said disc portion of said rotor to effect a deceleration of said rotor;  
a drum brake assembly for acting on said drum portion of said rotor to effect a parking brake function independent of said disc brake assembly;  
a backing plate supportingly mounting said drum brake assembly within said rotor drum portion; and  
a two-piece adapter having a first portion made of a first metal and supportingly mounting said disc brake assembly about said rotor disc portion and a second portion fastened to said first portion, said second portion being made of a second metal and being fastened to said backing plate.
2. The system of claim 1, wherein said first portion of said two-piece adapter is made from cast iron.
3. The system of claim 1, wherein said second portion of said two-piece adapter is made from a single stamping of steel.
4. The system of claim 1, wherein said second portion of said adapter is welded to said backing plate.
5. The system of claim 1, wherein said second portion is integrally formed with said backing plate.
6. The system of claim 1, wherein said second portion of said adapter is fastened to said first portion by a plurality of bolts.

-9-

7. The system of claim 1, wherein said adapter second portion comprises a single stamping of steel that further comprises a reinforcement rib along a perimeter of said second portion, adjacent and essentially following an outer edge of said second portion.

8. The system of claim 1, wherein said adapter second portion comprises a single stamping of steel that has a plurality of reinforcement ribs.

9. The system of claim 8, wherein said adapter second portion comprises a base portion and a pair of essentially flat wing portions extending from said base

10. The system of claim 9, wherein said reinforcement ribs are disposed on said base portion, said wing portions are fastened to said adapter first portion and said base portion is fastened to said backing plate.

---

-10-

11. A vehicle caliper brake adapter, comprising:  
a first portion made of a first metal and adapted to mountingly support a disk brake assembly; and  
a second portion made of a second metal and having a base and two wings extending away from said base, said wings being connected to said first portion, said base having at least one reinforcement rib to increase the structural rigidity of said second portion.
12. The adapter of claim 11, wherein said first portion is made of cast iron and said second portion is made of a single stamping of steel.
13. The adapter of claim 11, wherein said first portion and said second portion are connected by a plurality of threaded members extending through a plurality of corresponding bores defined through said first and second portions, respectively.
14. The adapter of claim 11, wherein said first portion is welded to said second portion.
15. The adapter of claim 11, wherein said rib is defined about a periphery of said base.
- 
16. The adapter of claim 11, wherein said base has a first surface in a first plane and a second surface extending inwardly from an outer periphery of said base in a second plane and wherein said rib comprises an intersection between said first and second surfaces.
17. The adapter of claim 15, wherein said rib extends into at least a portion of each of said wings.
18. The adapter of claim 11, further comprising a plurality of reinforcement ribs.

**1/2**

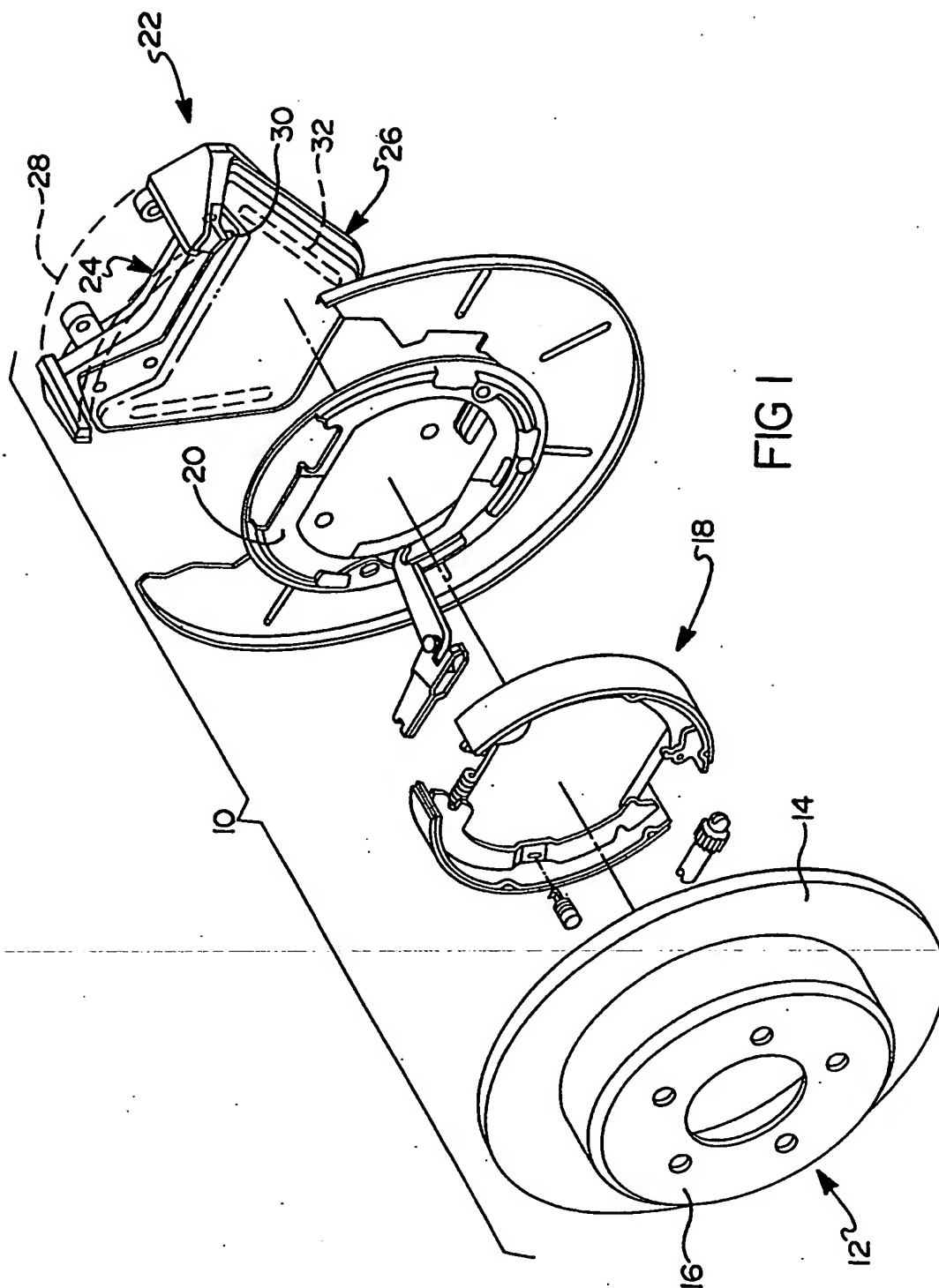


FIG 1

**SUBSTITUTE SHEET (RULE 26)**

2/2

FIG 2

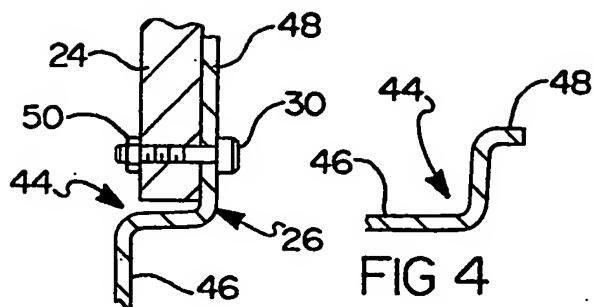
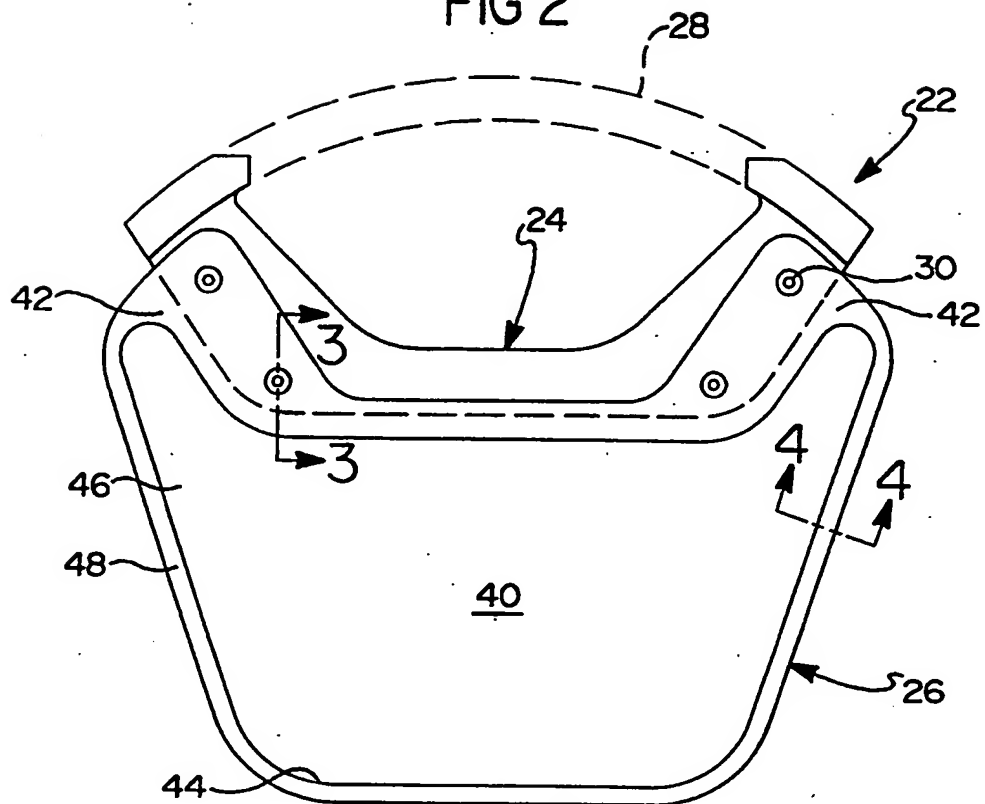


FIG 3

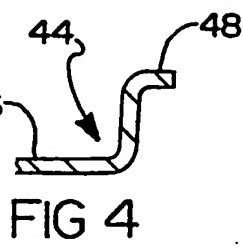


FIG 4

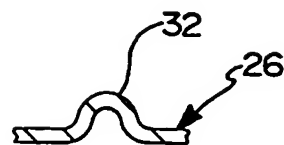


FIG 5

SUBSTITUTE SHEET (RULE 26)

# INTERNATIONAL SEARCH REPORT

Internat Application No  
PCT/US 96/08159

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 F16D63/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 F16D B60T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 332 311 A (NOMURA) 1 June 1982  see column 1, line 59 - line 67; figures ---	1-3,5-7, 9,11-13, 15,17
A	US 4 784 241 A (TEMPLE ET AL.) 15 November 1988  see column 1, line 7 - line 40 see column 2, line 16 - column 3, line 21 see column 4, line 5 - line 48 see figures ---	1-3,5-7, 9,11-13, 15,17
A	GB 2 047 365 A (LUCAS INDUSTRIES) 26 November 1980 see page 2, line 35 - page 3, column 42; figures 1-3  --- -/-	1-3,5, 11-13

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "A" document member of the same patent family

Date of the actual completion of the international search

31 October 1996

Date of mailing of the international search report

06. 11. 96

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Becker, R

# INTERNATIONAL SEARCH REPORT

Internat. Application No  
PCT/US 96/08159

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 4 046 231 A (OHORI ET AL.) 6 September 1977  see column 2, line 24 - line 46; figures  -----</p>	<p>1,2,9,  11,12,14</p>



# INTERNATIONAL SEARCH REPORT

Information on patent family members

Internati Application No  
PCT/US 96/08159

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4332311	01-06-82	NONE	
US-A-4784241	15-11-88	CA-A- 1293206	17-12-91
		US-A- 4995481	26-02-91
		AU-B- 592007	21-12-89
		AU-A- 7678387	31-03-88
		EP-A- 0261357	30-03-88
		JP-A- 63088336	19-04-88
GB-A-2047365	26-11-80	DE-A- 3012137	09-10-80
US-A-4046231	06-09-77	JP-A- 52061675	21-05-77

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**